

New Hampshire Volunteer Lake Assessment Program

2002 Interim Report for Stinson Lake Rumney



NHDES
Water Division
Watershed Management Bureau
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OBSERVATIONS & RECOMMENDATIONS

As part of the state's lake survey program, DES biologists performed a comprehensive lake survey on **STINSON LAKE** this summer. Publicly-owned recreational lakes in the state are often surveyed approximately every ten to fifteen years. In addition to the tests normally carried out by VLAP, biologists tested for certain indicator metals and nitrogen, created a map of the lake bottom contours (referred to as a bathymetric map), and mapped the abundance and distribution of the aquatic plants along the shoreline. Some data from this lake survey have been included in this report and has been added to the historical database for your lake/pond. If you would like a complete copy of the raw data from the lake survey, please contact the DES Limnology Center at (603) 271-3414 or (603) 271- 3414. A final report should be available in 2004 and a copy will be available at any state library.

After reviewing data collected from **STINSON LAKE**, the program coordinators recommend the following actions.

FIGURE INTERPRETATION

- **Figure 1 and Table 1:** The graphs in Figure 1 (Appendix A) show the historical and current year chlorophyll-a concentration in the water column. Table 1 (Appendix B) lists the maximum, minimum, and mean concentration for each sampling season that the lake/pond has been monitored through the program.

Chlorophyll-a, a pigment naturally found in plants, is an indicator of the algal abundance. Because algae are usually microscopic plants that contain chlorophyll-a and are naturally found in lake ecosystems, the chlorophyll-a concentration found in the water gives an estimation of the concentration of algae or lake productivity. The mean (average) summer chlorophyll-a concentration for New Hampshire's lakes and ponds is 7.02 ug/L.

Similar to the summer of 2001, the summer of 2002 was filled with many warm and sunny days and there was a lower than normal amount of rainfall during the latter-half of the summer. The combination of these factors resulted in relatively warm surface

waters throughout the state. The lack of fresh water to the lakes/ponds reduced the rate of flushing which may have resulted in water stagnation. Due to these conditions, many lakes and ponds experienced increased algae growth, including filamentous green algae (the billowy clouds of green algae typically seen floating near shore), and some lakes/ponds experienced nuisance blue-green algae blooms.

The historical data (the bottom graph) show that the 2002 chlorophyll-a mean is ***much less than*** the state mean. Overall, visual inspection of the historical data trend line (the bottom graph) shows ***a relatively stable*** in-lake chlorophyll-a trend, meaning that the concentration has ***remained stable, and well below the state mean***, since monitoring began. We hope this trend continues!

For the 2003 annual report, since there will have been at least 10 consecutive years of sample collection for the lake/pond, we will conduct a statistical analysis of the data. This will allow us to objectively determine if there has been a significant change in the annual mean chlorophyll-a concentration since monitoring began.

While algae are naturally present in all lakes/ponds, an excessive or increasing amount of any type is not welcomed. In freshwater lakes/ponds, phosphorus is the nutrient that algae depend upon for growth. Therefore, algal concentrations may increase when there is an increase in nonpoint sources of nutrient loading from the watershed, or in-lake sources of phosphorus loading (such as phosphorus releases from the sediments). It is important to continually educate residents about how activities within the watershed can affect phosphorus loading and lake quality.

- **Figure 2 and Table 3:** The graphs in Figure 2 (Appendix A) show historical and current year data for lake/pond transparency. Table 8 lists the maximum, minimum and mean transparency data for each sampling season that the lake/pond has been monitored through the program.

Volunteer monitors use the Secchi-disk, a 20 cm disk with alternating black and white quadrants, to measure water clarity (how far a person can see into the water). Transparency, a measure of water clarity, can be affected by the amount of algae and sediment from erosion, as well as the natural colors of the water. The mean (average) summer transparency for New Hampshire's lakes and ponds is 3.7 meters.

Two different weather related patterns occurred this past spring and summer that influenced lake quality during the summer season.

In late May and early June of 2002, numerous rainstorms occurred. Stormwater runoff associated with these rainstorms may have increased phosphorus loading, and the amount of soil particles washed into waterbodies throughout the state. Some lakes and ponds experienced lower than typical transparency readings during late May and early June.

However, similar to the 2001 sampling season, the lower than average amount of rainfall and the warmer temperatures during the latter-half of the summer resulted in a few lakes/ponds reporting their best-ever Secchi-disk readings in July and August (a time when we often observe reduced clarity due to increased algal growth)!

The historical data (the bottom graph) show that the 2002 mean transparency is ***much greater than*** the state mean.

Overall, visual inspection of the historical data trend line (the bottom graph) shows ***a relatively stable*** trend for in-lake transparency, meaning that the transparency has ***remained stable and much greater than the state mean*** since monitoring began. We hope this trend continues!

For the 2003 annual report, since there will have been at least 10 consecutive years of sample collection for the lake/pond, we will conduct a statistical analysis of the data. This will allow us to objectively determine if there has been a significant change in the annual mean transparency since monitoring began.

Typically, high intensity rainfall causes erosion of sediments into the lake/pond and streams, thus decreasing clarity. Efforts should continually be made to stabilize stream banks, lake/pond shorelines, disturbed soils within the watershed, and especially dirt roads located immediately adjacent to the edge of tributaries and the lake/pond. Guides to Best Management Practices designed to reduce, and possibly even eliminate, nonpoint source pollutants are available from NHDES upon request.

- **Figure 3 and Table 8:** The graphs in Figure 3 (Appendix A) show the amounts of phosphorus in the epilimnion (the upper layer) and the hypolimnion (the lower layer); the inset graphs show current year data. Table 8 (Appendix B) lists the annual maximum, minimum, and median concentration for each deep spot layer and each tributary since the lake/pond has joined the program.

Phosphorus is the limiting nutrient for plant and algae growth in New Hampshire's freshwater lakes and ponds. Too much phosphorus in a lake/pond can lead to increases in plant and algal growth over time. The median summer total phosphorus concentration in the

epilimnion (upper layer) of New Hampshire's lakes and ponds is 11 ug/L. The median summer phosphorus concentration in the hypolimnion (lower layer) is 14 ug/L.

The historical data for the epilimnion (upper layer) show that the 2002 total phosphorus mean is ***much less than*** the state median. Overall, visual inspection of the historical data trend line for the epilimnion shows ***a slightly increasing*** total phosphorus trend, which means that the concentration has ***slightly worsened*** in the epilimnion since monitoring began.

The historical data for the hypolimnion (lower layer) show that the 2002 total phosphorus mean is ***slightly less than*** the state median. Overall, the historical data trend line for the hypolimnion shows ***a slightly increasing*** total phosphorus trend, which means that the concentration has ***slightly worsened*** in the hypolimnion since monitoring began.

For the 2003 annual report, since there will have been at least 10 consecutive years of sample collection for the lake/pond, we will conduct a statistical analysis of the data. This will allow us to objectively determine if there has been a significant change in the annual mean total phosphorus concentration since monitoring began.

One of the most important approaches to reducing phosphorus loading to a waterbody is to continually educate watershed residents about its sources and how excessive amounts can adversely impact the ecology and value of lakes and ponds. Phosphorus sources within a lake or pond's watershed typically include septic systems, animal waste, lawn fertilizer, road and construction erosion, and natural wetlands. If you would like to educate watershed residents about how they can help to reduce phosphorus loading into the lake/pond, please contact the VLAP Coordinator.

TABLE INTERPRETATION

➤ Table 2: Phytoplankton

Small amounts of the cyanobacteria ***Merismopedia*** and ***Microcystis*** were observed in the plankton sample this season. ***Microcystis, if present in large amounts, can be toxic to livestock, wildlife, pets, and humans*** (Refer to page 14 of the "Biological Monitoring Parameters" section of this report for a more detailed explanation). Cyanobacteria can reach nuisance levels when excessive nutrients and favorable environmental conditions occur.

As with the summer of 2001, we observed that some lakes and ponds had cyanobacteria present during the 2002 summer season, likely due to the many warm and sunny days that occurred this summer,

which may have accelerated algal and bacterial growth. In addition, the lower than normal amount of rainfall during the latter half of the summer, meant that the slow flushing rates resulted in less phosphorus exiting the lake outlet and more phosphorus being available for plankton growth.

The presence of cyanobacteria serves as a reminder of the lake's/pond's delicate balance. Watershed residents should continue to act proactively to reduce nutrient loading into the lake/pond by eliminating fertilizer use on lawns, keeping the lake/pond shoreline natural, re-vegetating cleared areas within the watershed, and properly maintaining septic systems and roads.

In addition, residents should also observe the lake/pond in September and October during the time of fall turnover (lake mixing) to document any blooms that may occur. Cyanobacteria have the ability to regulate their depth in the water column by producing or releasing gas from vesicles. However, occasionally lake mixing can affect their buoyancy and cause them to rise to the surface and bloom. Wind and currents tend to "pile" cyanobacteria into "surface scums" that accumulate in one section of the lake/pond. If a fall bloom occurs, please contact the VLAP Coordinator.

➤ **Table 4: pH**

Table 4 (Appendix B) presents the in-lake and tributary current year and historical pH data.

pH is measured on a logarithmic scale of 0 (acidic) to 14 (basic). pH is important to the survival and reproduction of fish and other aquatic life. A pH below 5.5 severely limits the growth and reproduction of fish. A pH between 6.5 and 7.0 is ideal for fish. The mean pH value for the epilimnion (upper layer) in New Hampshire's lakes and ponds is 6.5, which indicates that the surface waters in state are slightly acidic. For a more detailed explanation regarding pH, please refer to page 16 of the "Chemical Monitoring Parameters" section of this report.

Due to the presence of granite bedrock in the state and the deposition of acid rain, there is not much that can be done to effectively increase lake/pond pH. There are some environmental and political solutions available to minimize this problem, however, there is not a cost effective restoration management technique that can be implemented.

➤ **Table 5: Acid Neutralizing Capacity**

Table 5 in Appendix B presents the current year and historic epilimnetic ANC for each year the lake/pond has been monitored through VLAP.

Buffering capacity or ANC describes the ability of a solution to resist changes in pH by neutralizing the acidic input to the lake. For a more detailed explanation, please refer to page 16 of the “Chemical Monitoring Parameters” section of this report.

➤ **Table 6: Conductivity**

Table 6 in Appendix B presents the current and historic conductivity values for tributaries and in-lake data. Conductivity is the numerical expression of the ability of water to carry an electric current. For a more detailed explanation, please refer to page 16 of the “Chemical Monitoring Parameters” section of this report.

➤ **Table 8: Total Phosphorus**

Table 8 in Appendix B presents the current year and historic total phosphorus data for in-lake and tributary stations. Phosphorus is the nutrient that limits the algae’s ability to grow and reproduce. Please refer to page 17 of the “Chemical Monitoring Parameters” section of this report for a more detailed explanation.

➤ **Table 9 and 10: Dissolved Oxygen and Temperature Profile Data**

Table 9 in Appendix B shows the dissolved oxygen/temperature profile(s) for the 2002 sampling season. Table 10 in Appendix B shows the historical and current year dissolved oxygen concentration in the hypolimnion (lower layer). The presence of dissolved oxygen is vital to fish and amphibians in the water column and also to bottom-dwelling organisms. Please refer to the “Chemical Monitoring Parameters” section of this report for a more detailed explanation.

The dissolved oxygen concentration was greater than **100%** saturation at **8** and **9** meters at the deep spot on the **August 13th** sampling event. Wave action from wind can also dissolve atmospheric oxygen into the upper layers of the water column. Layers of algae can also raise the dissolved oxygen in the water column, since oxygen is a by-product of photosynthesis. Considering that the depth of the photic zone (depth to which sunlight can penetrate into the water column) was approximately **9.5** meters on this date (as shown by the Secchi-disk transparency), and that the metalimnion (the layer of rapid decrease in water temperature and increase in density – a place where algae are often found) was located between approximately **8** and **12** meters, we suspect that an abundance of algae caused the oxygen super saturation.

The dissolved oxygen concentration was **high** at all depths sampled at the deep spot of the lake/pond, including the hypolimnion. As stratified lakes/ponds age, oxygen becomes **depleted** in the

hypolimnion (lower layer) by the process of decomposition. Specifically, the loss of oxygen in the hypolimnion results primarily from the process of biological oxidation of organic matter (i.e.; biological organisms using oxygen to break down organic matter), both in the water column and particularly at the bottom of the lake/pond where the water meets the sediment. The **high** oxygen level in the hypolimnion is a sign of the lake's/pond's overall good health.

➤ **Table 11: Turbidity**

Table 11 in Appendix B lists the current year and historic data for in-lake and tributary turbidity. Turbidity in the water is caused by suspended matter, such as clay, silt, and algae. Water clarity is strongly influenced by turbidity. Please refer to page 19 of the “Other Monitoring Parameters” section of this report for a more detailed explanation.

DATA QUALITY ASSURANCE AND CONTROL

Sample Receipt Checklist

Each time your monitoring group dropped off samples at the laboratory this summer, the laboratory staff completed a sample receipt checklist to assess and document if the volunteer monitors followed proper sampling techniques when collecting the samples. The purpose of the sample receipt checklist is to minimize, and hopefully eliminate, future re-occurrences of improper sampling techniques.

Overall, the sample receipt checklist showed that your monitoring group did an **excellent** job when collecting samples and submitting them to the laboratory this season! Specifically, the members of your monitoring group followed the proper field sampling procedures and there was no need for the laboratory staff to contact your group with questions, and no samples were rejected for analysis.

NOTES

- **Monitor's Note (7/14/02):** Not enough water to get sample from Collins Brook.
- **Monitor's Note (8/13/02):** Cross Road, Doe Town Brook, Collins Brook were all dry.
- **Monitor's Note (9/8/02):** Not enough water to get samples at Collins Brook, Doe Town Brook, and Cross Road Brook.

USEFUL RESOURCES

Changes to the Comprehensive Shoreland Protection Act: 2001 Legislative Session, NHDES Fact Sheet, (603) 271-3505, or www.des.state.nh.us/factsheets/sp/sp-8.htm

Cyanobacteria in New Hampshire Waters: Potential Dangers of Blue-Green Algae Blooms, NHDES Fact Sheet, (603) 271-3505, or www.des.state.nh.us/factsheets/wmb/wmb-10.htm

Managing Lakes and Reservoirs, Third Edition, 2001. Prepared by the North American Lake Management Society (NALMS) and the Terrene Institute in cooperation with the U.S. Environmental Protection Agency. Copies are available from NALMS (internet: www.nalms.org, phone 608-233-2836), and the Terrene Institute (internet: www.terrene.org, phone 800-726-4853)

Organizing Lake Users: A Practical Guide. Written by Gretchen Flock, Judith Taggart, and Harvey Olem. Copies are available from the Terrene Institute (internet: www.terrene.org, phone 800-726-4853)

Proper Lawn Care in the Protected Shoreland: The Comprehensive Shoreland Protection Act, WD-SP-2, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/sp/sp-2.htm

Swimmers Itch, WD-BB-2, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-2.htm

Use of Lakes or Streams for Domestic Water Supply, WD-WSEB-1-11, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/ws/ws-1-11.htm

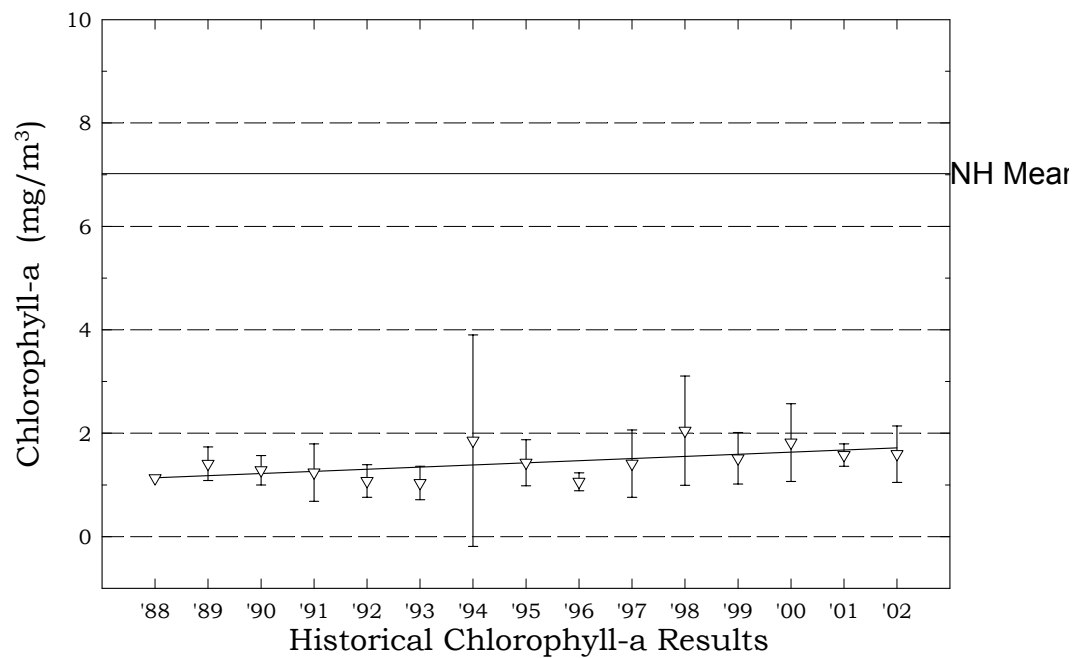
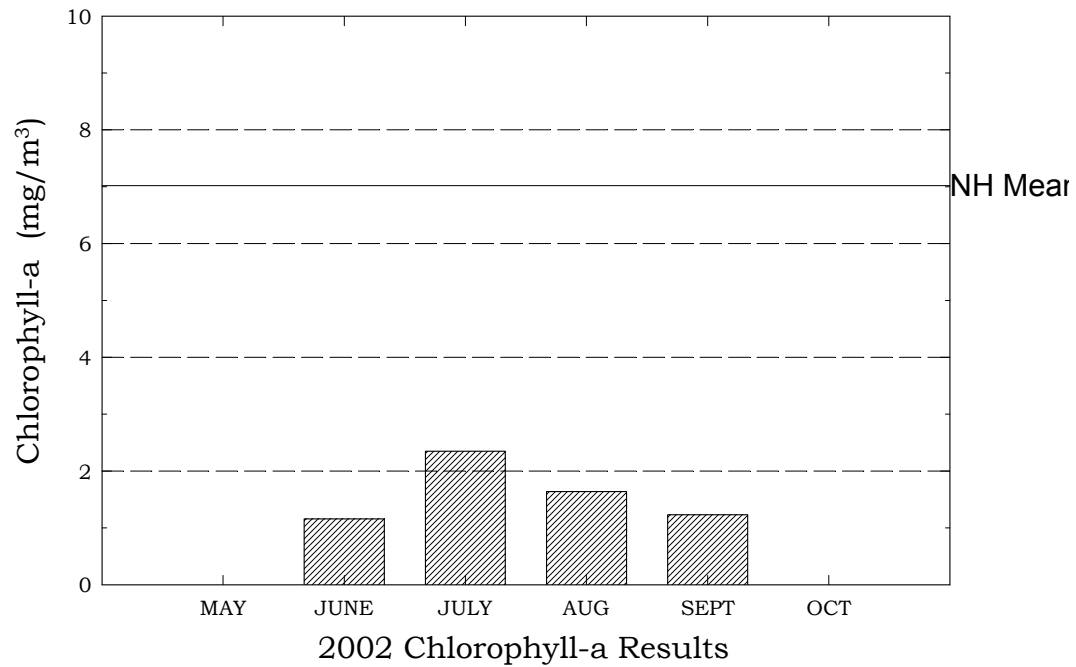
Water Milfoil, WD-BB-1, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-1.htm

Weed Watchers: An Association to Halt the Spread of Exotic Aquatic Plants, WD-BB-4, NHDES Fact Sheet, (603) 271-3503 or www.des.state.nh.us/factsheets/bb/bb-4.htm

Appendix A: Graphs

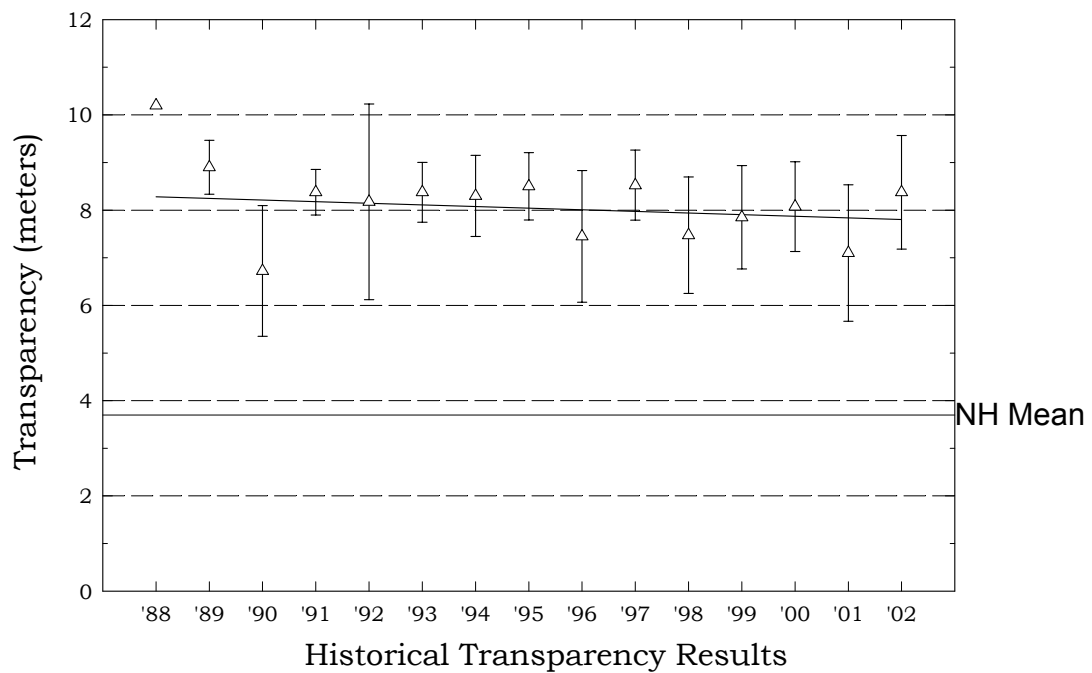
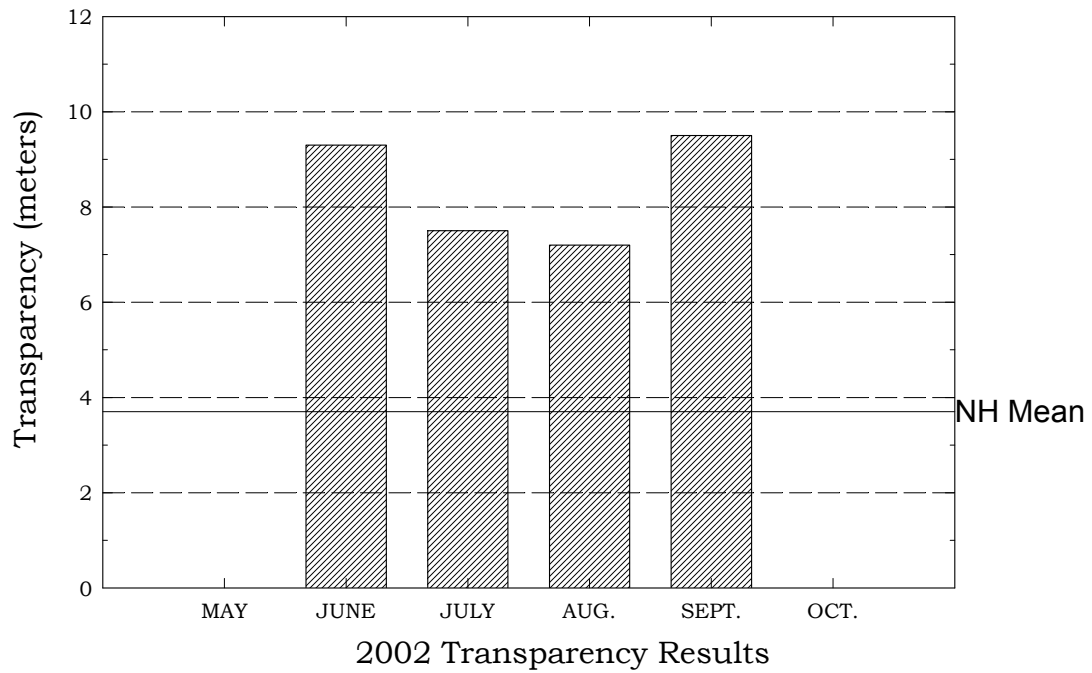
Stinson Lake, Rumney

Figure 1. Monthly and Historical Chlorophyll-a Results



Stinson Lake, Rumney

Figure 2. Monthly and Historical Transparency Results



Stinson Lake, Rumney

Figure 3. Monthly and Historical Total Phosphorus Data.

